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EXAMINER

UHLIR, NIKOLAS J

ART UNIT	PAPER NUMBER
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1773

DATE MAILED: 07/11/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/961,255

Applicant(s)

DIENY, BERNARD

Examiner

Nikolas J. Uhler

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 07 May 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-12 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) none is/are allowed.
- 6) ☒ Claim(s) 1-12 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413) Paper No(s) \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

### DETAILED ACTION

1. This office action is in response to the amendments/arguments dated 5/07/03.

The applicant's amendments to the instant specification, drawings and claims are sufficient to overcome the prior objection to these elements. Accordingly, these objections are hereby withdrawn. However, the applicants amendments are not deemed to overcome the prior art, for the reason set forth below in the section entitled "Response to Arguments."

#### ***Claim Rejections - 35 USC § 102***

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 1, 3-6, and 9-11 are rejected under 35 U.S.C. 102(b) as being anticipated by Swagten et al. (Physical Review B, Vol 53, Number 14, pp9108-9114).

4. Regarding the limitations of claim 1, wherein the applicant requires a spin valve device comprising at least one stack of layers comprising an electrically conductive, nonmagnetic layer between first (R) and second (R', F) magnetic layers, wherein the first and second magnetic layers have a magnetization in a certain direction and that at least one of the first and second magnetic layers has directly at an interface with the nonmagnetic layer a specular reflection of the conduction electrons that is dependent on the orientation of the spin of the electrons relative to the magnetization direction in the magnetic layer or layers.

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5. The examiner acknowledges that it is the duty of the examiner to read the claims in light of the specification. However, it is also the duty of the examiner to give the claims their broadest reasonable interpretation. Further, while the claims are read in light of the specification, the applicant is respectfully reminded that limitations from the specification are not read into the claims. Bearing this in mind, to be clear on the record, the applicant should note that the examiner interprets the phrase, "directly at the interface with the nonmagnetic layer" to allow for additional layers to be present between the spectrally reflecting layer and the nonmagnetic layer. For instance, a single layer present between a spectrally reflecting layer and the nonmagnetic layer is considered equivalent to the applicants claimed "interface" and thus such a structure reads on the applicants claims.

6. With respect to the limitations of claim 1, Swagten et al. teaches a spin valve device comprising the structure, 500 angstrom NiO/F1/NM1/F2/NM2/100 angstroms NiO (Second NiO layer), wherein F1 and F2 are 20 angstrom of Co and 40 angstroms of Co respectively and both NM1 and NM2 are manufactured from Cu (p 9108, right column "experiment"). The examiner takes the position that the second Co (FM2) layer is equivalent to applicants claimed 1st magnetic layer, as Co is known to be ferromagnetic. Further, the examiner takes the position that the first NiO layer is equivalent to applicants claimed 2nd magnetic layer, as NiO is antiferromagnetic. The first Co layer (FM1) is considered to be equivalent to applicants claimed interface. As the nonmagnetic layer is between the first NiO and 2nd Co layer (FM2) layer, the limitation in claim 1 requiring the nonmagnetic layer to be present between magnetic

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layer is met. Further, Cu is known to be nonmagnetic and conductive, and so meets the limitations of claim 1 requiring a nonmagnetic conductive layer. Regarding the requirement that a specular reflection of electrons be present directly at the interface between the non-magnetic and one of the magnetic layers, Swagten et al. teaches that bottom NiO layer spectrally reflects electrons at the border with the first Co layer and the NiO layer whereas the top NiO layer does not (page 9112, left column, line 54-page 9113, left column, line 55). As stated above, the examiner considers the first Co layer to be equivalent to applicants claimed "interface." Thus, the limitations of claim 1 requiring the specular reflection of electrons "directly at the interface with the non magnetic layer are met.

7. Regarding the limitations of claim 3, wherein the applicant requires the electrically conductive nonmagnetic layer to be Cu, Ag, or Au. Swagten uses Cu as the non-magnetic layer. Thus, the limitations of claim 3 are met.

8. Regarding the limitations of claim 4, wherein the applicant requires the non-magnetic layer to have a thickness less than approximately 10nm. Swagten teaches specific examples wherein 20 angstrom (2nm) Cu layers are utilized for the non-magnetic layer. Thus, the limitations of claim 4 are met.

9. Regarding the limitations of claim 5, wherein the applicant requires an antiferromagnetic layer to be adjacent to at least one of the first and second magnetic layers. The term "adjacent" is interpreted by the examiner as open language that does not necessarily require the antiferromagnetic layer to be in direct contact with one of the magnetic layers. Bearing this interpretation in mind, Swagten teaches using a anti-

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ferromagnetic NiO above the 2nd ferromagnetic layer. As NiO is known to be antiferromagnetic, this limitation is met. Thus, the limitations of claim 5 are met.

10. Regarding the limitations of claim 6, wherein the applicant requires a substrate. Swagten et al. forms the stack on glass substrates (right column, p9108, experimental). Thus, the limitations of claim 6 are met.

11. With respect to the limitations of claim 9, wherein the applicant requires the first magnetic layer to spectrally reflect electrons, wherein the second magnetic layer does not. Swagten specifically teaches that the lower portion of the stack (NiO/FM1/NM1) spectrally reflects electrons, whereas the upper portion of the stack (NM2/NiO) does not (page 9112, left column, line 54-9113, left column, line 55). Thus the limitations of claim 9 are met.

12. Regarding the limitations of claim 10, wherein the applicant requires the second magnetic layer having transmission of electrons to be formed from a material selected from transition metals, alloys of Ni and/or iron and/or cobalt. Swagten et al. teaches that the second layer having transmission of electrons is made of NiO, as shown above for claims 1 and 9. As Ni is a transition metal, the limitations of claim 10 are met.

13. Regarding the limitations of claim 11, wherein the applicant requires a ferromagnetic layer to be adjacent to the second magnetic layer, this limitation is met as set forth above, as Swagten et al. teaches a ferromagnetic Co layer adjacent to the upper antiferromagnetic NiO layer.

***Claim Rejections - 35 USC § 103***

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14. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

15. Claims 1-3, 5-6, and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Singleton et al. (US2002/0012207A1).

16. As stated above, the examiner interprets claim 1 in the same manner set forth at sections 4-5 of this action.

17. With respect to the limitations of claim 1, Singleton et al. teaches a spin valve having the structure Seed/Antiferromagnetic layer/ Specular scattering layer/pinned layer/spacer/free layer/specular scattering layer (figure 1a). Both the pinned and the free layers are ferromagnetic, and the spacer layer is non-magnetic. The specular scattering layers are made from antiferromagnetic materials such as NiO, Fe<sub>2</sub>O<sub>3</sub> and Fe<sub>3</sub>O<sub>4</sub>, and others (section 8).

18. Therefore it would have been obvious to one with ordinary skill in the art to select NiO, Fe<sub>2</sub>O<sub>3</sub> or Fe<sub>3</sub>O<sub>4</sub> to form the scattering layers in Singleton et al., as they are taught to be equivalent.

19. The applicant is respectfully reminded that substitution of equivalents requires no express motivation as long as the prior art recognizes the equivalency. *In Re Fount* 213 USPQ 532 (CCPA 1982); *In Re Siebentritt* 152 USPQ 618 (CCPA 1967); *Grover Tank & Mfg. Co. Inc V. Linde Air Products Co.* 85 USPQ 328 (USSC 1950)

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20. It is the examiners position that when  $\text{NiO}$ ,  $\text{Fe}_2\text{O}_3$  or  $\text{Fe}_3\text{O}_4$  are used as the specular scattering layers, the magnetic layer limitations of claim 1 are met, as these materials are known to be magnetic. When these materials are utilized, it is the examiners position that the specular scattering layers are equivalent to applicants claimed 1st and 2nd magnetic layers, and the pinned/free layers are equivalent to applicants claimed interface. Thus, as the specular reflection of electrons occurs at the border of the pinned/free layer and a respective scattering layer, the specular reflection of electrons occurs "directly at the interface" with the non magnetic layer.

21. Regarding the limitations of claim 2, wherein the applicant requires the magnetic layer or layers R R' to be formed from one of the materials selected from ferrimagnetic oxides based on iron and/or nickel and/or cobalt and/or chrome or ferromagnetic nitrides based on iron and/or nickel and/or cobalt.

22. It would have been obvious to one with ordinary skill in the art at the time the invention was made to select  $\text{Fe}_3\text{O}_4$  as the material for the scattering layers, as it is taught to be equivalent to the other materials listed as suitable. It is the examiners position that when  $\text{Fe}_3\text{O}_4$  is used as the material for the scattering layers, the limitations of claim 2 are met, as  $\text{Fe}_3\text{O}_4$  is a known ferrimagnetic oxide.

23. Regarding the limitations of claim 3, wherein the applicant requires the nonmagnetic layer to be selected from Cu, Ag, or Au. Singleton teaches that the spacer layer is an alloy of Cu (section 25). Thus this limitation is met.

24. With respect to the limitations of claim 5, wherein the applicant requires an antiferromagnetic layer to be adjacent one of the first and second magnetic layers. As



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stated above for claim 1, Singleton teaches a structure which has an antiferromagnetic layer adjacent one of the specular scattering layers. Thus, when NiO, Fe<sub>2</sub>O<sub>3</sub> or Fe<sub>3</sub>O<sub>4</sub> is utilized as the specular reflection layer (thus meeting applicants magnetic layer requirements), the limitations of claim 5 are met.

25. Regarding claim 6, wherein the applicant requires the stack of layers to be deposited on a substrate. The examiner takes the position that the seed layer of Singleton et al. is equivalent to applicants claimed substrate. Thus, this limitation is met.

26. Regarding the limitations of claim 7, wherein the applicant requires a protective layer. Singleton et al. teaches a top spin valve structure in which the antiferromagnetic layer is deposited on top of the second specular scattering layer (see figures 2a and 2b). It is the examiners position that when the antiferromagnetic layer is formed on top of the second scattering layer it is equivalent to applicants protective layer.

27. Regarding claim 8, wherein the applicant requires the both magnetic layers to spectrally reflect electrons. This limitation is met as set forth above for claim 2, as Singleton et al. clearly teaches the use of 2 spectral reflection layers.

28. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Swagten et al.

29. Swagten does not explicitly teach a spin valve having the structure R/NM/F/NM/R', wherein R and R' are magnetic layers which exhibit specular reflection of electrons, F is a magnetic layer which exhibits diffusion of electrons, and NM is a nonmagnetic conductive spacer layer, as required by claim 12.

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30. However, Swagten et al. does teach that replacing the top NiO layer with an antiferromagnetic CoO layer would allow the spin dependent specular reflection of electrons at the upper boundary as a function of temperature to be studied (left column page 9113).

31. Therefore it would have been obvious to one with ordinary skill in the art to replace the upper NiO layer of Swagten with an antiferromagnetic CoO layer.

32. One would have been motivated to make this modification in order to explore the mechanism that governs the spin dependent reflection of electrons at the upper barrier of the spin valve structure of Swagten et al.

33. When CoO is used to replace the upper NiO layer of Swagten, this results in a spin valve having the structure, NiO/F1/NM1/F2/NM2/CoO, wherein NiO and CoO layers reflect electrons. As F2 is a ferromagnetic material such as cobalt, and is not taught to reflect electrons, the limitations of claim 12 are met, as this would result in a structure reading on applicants claim language.

***Examiners Note***

34. From careful consideration of the applicants arguments and specification, it appears that the applicant believes the instant claim language limits the spin valve structure claimed to a structure wherein a first magnetic layer and second magnetic layer are formed on opposite sides of a non-magnetic conductive layer, such that the magnetic layers are directly formed on opposing surfaces of the conductive layer, wherein at least one of the first and second magnetic layers spectrally reflects electrons at the boundary between the non-conductive metal layer and at least one of the first and

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second magnetic layers. However, this is not the case, as the language utilized in the instant claims is open to the interpretation that additional layers between the first and second magnetic layers and the conductive layer can be present. These additional layers constitute an "interface" with the non-magnetic layer. If the applicant wishes to exclude this interpretation, the examiner respectfully suggests the applicant define the structure of the invention utilizing closed terms. For example, if the applicant wishes to require a magnetic layer on a substrate, such that no other layers can be present between the substrate and the magnetic layer, suitable language would be "a magnetic layer that is formed directly in contact with the surface of a substrate."

#### ***Response to Arguments***

35. Applicant's arguments filed 5/07/03 have been fully considered but they are not persuasive. In the instant case, the applicant has argued that the cited prior art does not teach the applicants required specular reflection of electrons "directly at the interface with the non-magnetic layer." the examiner respectfully disagrees, as the applicants claims are open to the interpretation that additional layers can be present between the claimed magnetic layer and the non-magnetic layer. These additional layers are equivalent to applicants claimed interface. The applicant's arguments are not persuasive because they are directed towards limitations that are not present in the claims. Thus, the rejection of the instant claims over Swagten and Singleton is hereby maintained.

#### ***Conclusion***

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36. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.


Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nikolas J. Uhlir whose telephone number is 703-305-0179. The examiner can normally be reached on Mon-Fri 7:30 am - 5 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Paul Thibodeau can be reached on 703-308-2367. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9310 for regular communications and 703-872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-305-

0389.

WD  
2/8/03

  
Paul Thibodeau  
Supervisory Patent Examiner  
Technology Center 1700